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ABSTRACT

Baseline information about numeracy education provision in the United States was collected in a questionnaire completed by 350 (57.9%) of 650 adult education programs surveyed. The usable responses yielded data about numeracy education provided to 774,955 students in 15 states. Among the study's main findings were the following: more than 80% of adult students receive some math-related instruction; fewer than 5% of teachers in programs providing numeracy education are certified to teach mathematics, and few have received any preservice training in mathematics instruction; administration of standardized tests is the most common method used to assess the mathematics skills of incoming students; and although more than 80% of programs report having access to computer software for mathematics instruction, fewer than 25% of students in those programs use such software. Three recommendations were made: teachers should receive more training in adult mathematics instruction; programs should use more comprehensive ways of assessing students' mathematics-related knowledge and achievement; and reporting procedures need to be developed to provide state and federal agencies with information regarding adult students receiving mathematics instruction. (Appended are the survey instrument and nine tables summarizing the data collected. Contains 43 references.) (MN)

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NATIONAL CENTER ON ADULT LITERACY

WHO COUNTS IN ADULT LITERACY PROGRAMS?

A NATIONAL SURVEY OF NUMERACY EDUCATION

Iddo Gal
Alex Schuh
National Center on Adult Literacy
University of Pennsylvania

NCAL TECHNICAL REPORT TR94-09
DECEMBER 1994

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WHO COUNTS IN ADULT LITERACY PROGRAMS?

A National Survey of Numeracy Education

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Abstract

This survey collected baseline information about numeracy provision in the United States in order to facilitate planning and prioritizing of numeracy-related educational activities. Responses from 350 adult education programs in 15 states were used to examine (a) the extent of math-related activities in programs, (b) staff training, (c) assessment frameworks, and (d) the use of computers for teaching math. Key findings were that (a) more than 80% of adult students receive some math-related instruction; (b) less than 5% of teachers in programs are certified to teach mathematics, and few receive preservice training in mathematics instruction; (c) mathematical skills of incoming students are assessed mostly by standardized tests; and (d) over 80% of programs report the availability of computer software for math instruction, yet less than 25% of students in those programs use such software. Results point to the need to significantly enhance staff training, consider changes in reporting procedures, change assessment practices, and improve the use of technology for instruction.

INTRODUCTION

Quantitative and mathematical skills traditionally have been considered a basic skill area, and are required in a wide range of contexts in adult lives and workplaces. Despite the importance of numeracy skills, several recent sources of data suggest that adult numeracy skills in the United States are currently low. These data include, for example, the alarming results from the National Adult Literacy Survey (NALS) (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993) regarding adults' performance on the quantitative literacy and document literacy scales; earlier results from the Young Adult Literacy Survey (YALS) (Kirsch & Jungeblut, 1986); and data from the Comprehensive Adult Student Assessment System (CASAS) (Simon, John, & Rickard, 1990). These sources show the low functional math skills of participants in literacy and job-preparation programs in California and other states. Secondary indicators, such as the National Assessment of Education Progress (NAEP) (Mullis, Dossey, Owen, & Phillips, 1991), point to American high school students' consistently low performance in mathematics.

Despite the centrality of mathematical skills in the functional, personal, educational, and employment-related life-contexts of adults, and the recognizable gap between desired and actual numeracy skills levels, there has not been much visible attention to the "numeracy" aspect of adult literacy education (Gal, 1993). Information about mathematics-related instructional activities is lacking in practically all formal reports released by federal and state agencies, and few if any discussions of adult numeracy development can be found in the professional literature aimed at adult educators. In a recent review of adult literacy programs in all 50 states in the United States, for example, only a small minority of states reported on mathematics instruction (Pelavin Associates, 1991). In examining recent reports about adult education activities in 20 states for the program year 1991-1992, we found that less than one quarter of the states mentioned any explicit math-related activities. When mathematics instruction was mentioned, it was listed only as one of several topics that were "also" covered—after reading, writing, and other literacy skills. No explicit data regarding the level or type of math-related activity were provided by the reports.

The lack of comprehensive data about the math-related aspects of adult literacy programs weakens the ability of decision makers and planners to contemplate ways for addressing the numeracy needs of adult learners. In order to facilitate planning and prioritizing of numeracy-related educational activities, the present survey was designed to collect baseline information about numeracy provision in the United States, pertaining to four separate yet interrelated issues: (a) extent of math-related activities in programs, (b) assessment frameworks, (c) staffing and staff development, and (d) use of computers for teaching mathematics to adults.

EXTENT OF ACTIVITY

How many participants in adult literacy/education programs are engaged in some math-related activity? Reports on adult education activities produced by state or federal agencies usually characterize performance of programs in terms of administrative parameters (e.g., numbers of students served; rates of

recruitment, retention, and promotion of students; demographic characteristics of participants; expenditure levels; or personnel figures). Statistical data pertaining to instructional aspects of programs specify only the *level* of instruction, but not the *content* of instructional activities.[1] As a result, there is no way to know the prevalence of math-related activities in adult literacy programs, nor, for that matter, the prevalence and nature of instruction in other content domains. Yet, data about the extent of math-related activity are needed to inform decisions about the allocation of resources at the program, state, and federal levels.

In order to collect information on student participation in math-related activities in programs, the survey asked for the percentage of students in the program (a) who were preparing for the GED examination (who are all developing their math skills), (b) who were not preparing for the GED exam and were taking math, and (c) who were not preparing for the GED and were not taking math. The study chose to ask programs to report on percentage of students involved in GED- and non-GED-focused instruction, rather than to use the current reporting mode of percentage of students at the ASE and ABE levels, as it was thought that the former method would more accurately capture the extent of math-related activity in programs. Also, programs in their daily activity most often consider students in terms of their relation to preparation for the GED exam, and use the ASE/ABE distinction largely for administrative purposes.

STAFF

What are the qualifications of the teaching force for teaching mathematics? The question of whether instructors and tutors are well prepared to teach mathematics and develop students' numeracy skills is critical in any discussion of the capability of programs to improve learners' numeracy skills. Yet, only sporadic information is available in official reports regarding issues of staff and staff training; most states report in their annual reports only anecdotal information, if any, regarding the instructional background of staff. A recent study of staff development in ABE and ESL programs across the United States (Tibbetts, Kutner, Hemphill, & Jones, 1991) estimated that most volunteer tutors (who constitute between 25% and 75% of the teaching force, depending on the state) receive between 8 and 20 hours of preservice training prior to working with adult students (see also Pelavin Associates, 1991). Tibbetts et al. (1991) suggested that preservice training is likely to focus mostly on reading and writing, but provided no estimates of the time invested in preparing tutors to engage mathematical issues. Regarding classroom teachers, the Tibbetts et al. report (1991) provided no information on math-related certification of teachers in programs, nor any information on math-related staff development provided by programs.

In order to collect information on the qualifications of programs to offer math instruction, proxy measures were used. Programs were asked to report how much time they spend on preservice activities designed for teachers and tutors, and to provide information about teachers' certification areas.

ASSESSMENT

How do programs assess students' mathematical skills? Clearly, a program's capability to determine its need to provide instruction in mathematics, to make placement decisions, and to create an instructional plan for individual students, depends greatly on the nature, quality, and scope of the methods used to assess learners' skills (Lytle & Wolfe, 1989). Assessment-based information can play another important role when programs attempt to evaluate progress made by learners, or when program sponsors, such as state and federal agencies, require that programs supply data to be used for the evaluation of program effectiveness (Venezky, 1992). To date, however, most calls for assessment have asked for data on students' reading, writing, and other language and communication skills, rather than assessment of mathematical skills.

It is well known that a majority of adult literacy programs presently use standardized tests to assess the skill levels of incoming students, and that many use the same tests for evaluating students' progress and for reporting learning gains (Sticht, 1990). The standardized tests most commonly used in ABE programs (TABE, ABLE, CASAS, and the official GED practice test; see Sticht, 1990 for more details) all include math-related subtests (or tasks, in the case of CASAS, which examines functional skills). Sticht (1990) has pointed to the various shortcomings of the math subtests of test batteries such as the TABE or ABLE. It was thus of interest to find what, if any, assessment methods programs use to assess the mathematical skills of students. It is possible that programs make little use of math subtests; many adult literacy/education programs and state agencies appear to report skill levels of students and learning gains only in reading, not in math (Pugsley, 1992). In the present survey, therefore, programs were asked to report what assessment instruments they employed at the intake stage to assess mathematical skills of incoming students.[2]

TECHNOLOGY

Recent reports highlight the potential benefits that adult literacy programs can obtain from increasing the use of technology, and point to various steps that programs can take to exploit this largely untapped resource (Office of Technology Assessment, 1993; Turner, 1993). The availability of computer programs for teaching mathematics at the K-12 level has increased dramatically in recent years, while garnering a broadening base of research support (see Kaput, 1992, for a recent review). Yet, it is unclear to what extent adult literacy programs are using such technology for mathematical education purposes. The present survey asked programs to report whether they possess computer software for teaching mathematics, and what percentage of students use such software.

To summarize briefly, the numeracy education survey gathered information on four areas of adult math education: (a) the extent to which adult education programs are providing mathematics instruction to their students; (b) the extent to which adult education instructors are certified or otherwise trained to teach math to students; (c) the extent to which programs are assessing students' math skills, and what kinds of assessments they are using; and (d) the extent to

which technology is available for math instruction in adult programs, and the extent to which it is actually being used by students.

COLLECTING THE DATA

APPROACH

The research framework used in the present study was designed in light of the diversity in structures and clientele common in adult literacy and adult education programs. Programs are organized and managed in varying ways across states, within states, and across localities. They may be independent, community-based organizations, or they may operate through school districts, through adult school systems, as part of community colleges, or in local libraries. States or local authorities exercise different degrees of control, or lack thereof, over curriculum, instruction, assessment, staff hiring, and staff development. Also, students served by literacy programs come from diverse backgrounds and present diverse goals, which may depend on local circumstances (e.g., welfare recipients in preemployment programs, prison inmates, displaced workers, employed individuals attempting to enhance their educational and job-related qualifications, new immigrants in ESL programs, and more).

Given the diversity in structure and situation of adult education programs nationally, the initial decision to study a small number of programs in detail was discarded in favor of conducting a large-scale mail survey to collect information about a great number of programs in different states and locations. However, as noted by Young (1992), the design of a sampling framework for a national survey of adult literacy activities is difficult and forces researchers to make many careful choices, and sometimes compromises. Two noteworthy problems that affected the design of the present survey involve the nature of a program and the paucity of information available in state program directories.

What counts as a program? State directories, which offer the main, and often the only, listing of adult education programs in a state, usually list all programs in a uniform way, regardless of their size (i.e., the number of students served) or the number of sites. Since adult literacy activities are organized in diverse ways that change within and across states, the term *program* may at times be misleading.

One may find a multiplicity of small and medium sized programs that are indeed single organizational entities with coordinated activities in one or few sites (e.g., a volunteer program in a church basement, or a school district that conducts some adult education activities in each school). In other cases, however, a program listed in a state directory may actually be a loosely coupled network of relatively independent entities, such as libraries or learning skills centers in a city, or satellite sites of a community college, each with its own system of student recruitment, instruction, assessment, and staff training, and perhaps operating some satellite sites of its own. Such networks may still be listed in a state directory as a single entry because the state is using a *single point of contact* system, or because entities in the

network have to report to a central agency or office when some of their funding comes from public sources, either federal, state, or local.

Despite this considerable variability in what constitutes a program, state directories offer only minimal contact information for each entry listed, usually lacking any details about program characteristics, such as services offered, program size, or the nature of the activity in any satellite sites. Additionally, most state directories do not distinguish between programs that provide teaching services and those that only provide access to resources, such as a library. This implies that, without a very expensive investment in presurvey preparations (e.g., contacting all programs in target states by phone or asking them to fill a preliminary "universe survey"; see Young, 1992), it would be difficult to construct a sample of programs within a state that would represent all programs in that state. Likewise, it would be difficult to ensure that students in programs selected to be surveyed are fully representative of the adult literacy/education scene at both the state and national levels. Even with a presurvey, it would not be possible to fully determine the representativeness of the resulting sample, since the most recent official data available from state and federal agencies about adult literacy/education activities always lag behind by two or three years; such data also do not represent activities in programs funded by private or nonprofit organizations.

In designing the sampling process and the questionnaire, it was necessary to balance the need to obtain a large sample and collect information about a variety of topics, against practical considerations and logistical limitations. Given a time frame and budget significantly smaller than those usually available for large-scale national surveys, a practical sampling design was chosen to satisfy two somewhat conflicting requirements:

- The sample should include a diverse cross-section of adult literacy and adult education programs in different states.
- Sampled programs should serve students whose characteristics closely match the most recent national statistical profile of students in adult education activities published by the Department of Education.

The first requirement was addressed through a stratified random sampling process described below. Satisfaction of the second requirement was evaluated by comparing the characteristics of the students in the programs sampled to the most recent national data available from the U.S. Department of Education (1993).

SAMPLE

With the above design goals and caveats in mind, 605 adult education sites were selected for this survey, using the following sampling framework. Fifteen states were chosen to represent a cross-section within each of the four geographical regions (West, Midwest, East, and South) used by the Department of Education in its reporting. In each region, one or two states with the largest adult student populations were selected (these tend to have large urban populations and are more industrial in nature), and one or two states with smaller populations were selected (these tend to be more rural in nature); also, states were chosen so that ESL populations of different sizes are represented. These choices were based on the most recent participation data published by the

Division of Adult Education and Literacy of the U.S. Department of Education (1993) for state-administered programs in each of the 50 states during the 1990-1991 program year.

In each state, programs were randomly chosen from the most recent directory of adult education programs in that state (usually for the 1991-1992 program year, but in two states for the 1990-1991 program year), which was obtained from the state director of adult education; 50% of the programs were chosen from urban areas and 50% from nonurban areas (maps were consulted where necessary). A minimum of 15 programs were selected from each of the 15 states; this number was increased in proportion to the percentage of adult students served in this state out of all adult students in the United States, to ensure that a larger number of programs would be sampled in states with a larger student population. Since the West and Southwest regions served somewhat larger numbers of adult students in 1990-1991, states from these two regions overall accounted for 60% of the programs in the sample, with the other two regions accounting for 40%.

Table 1 and Table 2 (see Appendix A) provide information about overall sample characteristics, and Table 3 provides information about the programs sampled in each state. As these tables and later discussion will suggest, the sampling design employed was successful and yielded a diverse sample of programs of different sizes whose student characteristics are similar to the national data provided by the U.S. Department of Education. One caveat should be kept in mind. As the sample was drawn from state directories, which include not only state-administered programs, but also nonprofit and local programs, the numbers can be expected to be slightly different from the U.S. Department of Education (1993) data, which includes information on state-administered programs only.

PROCEDURE

A questionnaire was mailed to all target programs in September 1993, and a follow-up was sent to programs that did not respond within four weeks. At least two attempts were made to contact by phone those programs that did not respond to the follow-up in order to urge them to respond and to ensure the proper routing of the questionnaire. The telephone contact was very successful in assisting the return of completed questionnaires within the brief time frame.

A questionnaire (see Appendix B) was developed on the basis of an early phone survey conducted in 1992 and a pilot mail survey conducted in 1993. To ensure a high return rate and thus a representative sample, the survey form was kept short to limit the burden of completing the survey and ensure that recipients would be willing to invest the time necessary to provide information beyond what is required by federal reporting guidelines.

Forced-choice questions were used when feasible to ease the task of responding to the survey, although respondents were encouraged to choose "Other" and provide additional information if their situation did not fit into the response options listed. Between 15 and 25% of the respondents used this option on most questions; coding schemes were developed to handle their responses. Since some of the data requested in the survey are not easily retrievable from official program records (e.g., number of teachers certified

in mathematics education, percentage of students starting at different skill levels), respondents were encouraged to provide the most accurate estimate possible, or otherwise indicate that no data were available. The "Data Unavailable" option was used by respondents on an as-need basis, decreasing the number of valid responses for some questions.

SAMPLE CHARACTERISTICS

A total of 404 (66.8%) out of 605 programs responded to the survey, as follows:

- *Complete*. Complete or near-complete survey forms were obtained from 350 (57.9%) programs, either directly or after follow-up calls to verify some responses, and these forms were further analyzed.
- *Invalid*. Forms with key information missing or with inconsistent information were obtained from 34 (5.6%) programs; such forms were considered invalid after three unsuccessful attempts to complete or verify information by phone, and were not analyzed.
- *Irrelevant*. Twenty programs (3.3%) indicated lack of involvement in any teaching activities (e.g., a library serving as a resource center) or otherwise considered their teaching activities outside the scope of the present survey (e.g., a math department in a community college offering a basic skills course to adults already holding a high-school diploma, or an ESL program teaching only basic English skills to elderly recent immigrants).

Tables 1 and 2 describe the key characteristics of the 350 programs that returned completed surveys. To simplify discussion of results, the term *program* is used as a generic label encompassing all types of organizations, agencies, and administrative structures that responded to the survey. As indicated in an earlier discussion, some programs are actually networks of separate agencies. A typical example is a network of community colleges in a large city that together have more than 100 sites yet report to a single office in the city, which was listed as the program in the state directories. In order to reduce any bias created when data are aggregated for all programs (which tends to overrepresent trends in multisite networks serving very large numbers of students), data are presented for the overall sample, as well as separately by program size (small: 1-599 students; medium: 600-9,999 students; large: 10,000 or more students).

Overall, the programs surveyed for this study served 774,955 students in the 12 months prior to when questionnaires were completed. Table 2 shows that the student characteristics in the programs surveyed are very similar to the national profile provided by the U.S. Department of Education (1993) for program year 1990-1991. As can be seen in Table 2, of the total of almost 3.8 million adult students served nationwide during that year, the percentages of students in ASE (adult secondary education) and ESL categories were 32% and 32%, respectively, with females constituting 52% of the students. Bearing mind that the populations were slightly dissimilar, and that the classifications of ASE and GED may vary slightly, the present sample yielded very similar figures of 28.8%, 35.5%, and 48.5% for GED, ESL, and female students, respectively.

Small programs accounted for roughly half of all programs surveyed (N=180), but altogether served only about 5% of the students serviced by all programs in the sample. About half (44%) of the small programs operated from a single site.

Given that distributions do not always follow the normal curve, median values are reported instead of means to reduce the influence of extreme cases. As Table 1 indicates, the median number of sites for large programs serving more than 10,000 students is 50 (range 3 to 257), suggesting that individual sites in such programs, which often operate independently, serve roughly the same number of students (around 200 students) and overall have the same characteristics as sites of medium or small programs.

Table 3 describes the numbers and proportions of students and the numbers and proportions of programs from each state in the sample, and allows comparison to the proportions of adult learners studying in state-administered programs in those states during the year 1990-1991 (U.S. Department of Education, 1993). As can be seen, the states serving the largest numbers of learners in state-administered programs in 1991 (California, Florida, Texas) were the states serving the largest numbers of students in our sample, with the exceptions of Michigan and Illinois. Some differences can be expected for three reasons: (a) the programs were surveyed two years after the collection of the Department of Education data; (b) the sample was taken from state directories of adult education, which include state, nonprofit, and locally administered programs, whereas the U.S. Department of Education information refers only to state-administered programs; and (c) programs may be organized differently in different states, so that sampling one program in one state may yield information on 100 students, while sampling one program in another state may yield information on 10,000 students—this could not be accounted for in the sampling process, as no information on program size was available for the individual states.

Study of Nonresponders

Telephone contacts were made with 30 programs randomly selected from those that had not returned questionnaires, to determine if their characteristics were substantially different from the responding programs. Reasons for not responding varied, but mainly had to do with administrative overload on program directors and other technical reasons, rather than with the nature of programs' instructional activities. Nonresponding programs were determined to be similar to responding programs—90.0% indicated that their activities involved teaching math to adults, almost always in a classroom setting.

It is possible that programs with a higher administrative overload could differ from the programs responding to this survey. Yet, based on the high overall return rate of the sample, and the similarity of nonresponding to responding programs in terms of math provision, the sample of responding programs was deemed representative of all programs in the original sample. Overall, the sample included a diverse cross-section of programs that served a student body representative of the population of students in state-administered adult literacy programs in the United States.

WHAT THE PROGRAMS REPORTED

EXTENT OF MATHEMATICS-RELATED INSTRUCTION

Table 4 (see Appendix A) presents the percentage of students receiving math-related instruction, by program size. Percentages were derived by dividing the total number of students receiving math-related instruction in all programs in each program-size category by the total number of students served by all programs in each program size category. Table 4 includes the percentage of students in classes in the programs who are studying at the GED level (31.4%) and presumably are learning math. Table 4 also includes the percentage of total students who were in classes who were non-GED and received some math instruction (50.8%). This percentage is remarkable in that the majority of students in adult education classes appear to be studying math below the "secondary" level, a situation that has not been previously reported. Overall, a total of 82.2% of all adult students in classes appear to receive some math-related instruction.

At the program level, 14 programs out of 350 (4%) reported having no math-related activity. These programs tended to be mostly small programs with an emphasis on tutoring and on language skills. In contrast, 250 programs (71.4%) reported that 50% or more of their students are involved in math-related activity at either the GED or non-GED level, and 138 (39.4%) programs reported that over 90% of their students are involved in math-related activity at either the GED or non-GED level. Two more findings pertaining to the extent of math-related instruction are noteworthy:

- *ESL.* Of all non-GED students who received some math-related instruction, 27%, 30%, and 39% were reportedly ESL students in small, medium, and large programs, respectively. These figures are important. Mathematics instruction for bilingual students or for students who have previously learned mathematical procedures different than those imparted by American K-12 schools may require a somewhat different approach than the one employed in mainstream American teaching (see, e.g., Gal, 1993; Laborde, 1990).
- *Tutoring.* In addition to students in groups who received math instruction, programs were asked for the percentage of students in one-on-one tutoring who received some math-related instruction. Overall, 200 (57.1%) of the 350 programs reported having tutoring activities; of these 324 programs, 146 (45.1%) reported that some of their tutees were engaged in math as part of their tutoring. A total of 42,410 learners were engaged in tutoring activities; of these, 50.2% were reportedly engaged in some math learning as part of their individual tutoring. The percentage of math-related activity in tutoring is of interest, considering that programs appear to allocate very little time to math instruction issues in their tutor-training programs (see below).

TEACHERS AND TEACHER PREPARATION

Do adult education programs have the personnel necessary to teach high-quality mathematics? Unfortunately, there is no direct way for measuring teacher qualification for providing adult numeracy education. There is no known certification program for adult mathematics education, nor any national standards in this area. (Such standards also do not exist for K-12 mathematics teachers.) As a proxy measure, programs were asked to report the number of teachers certified in adult education, elementary education, and mathematics education at the K-12 level. While data about teacher certification in the above fields cannot directly attest to teachers' qualifications for teaching mathematics to adults, such information can shed some light on the relative importance that programs place on recruiting teachers with backgrounds in mathematics. Such information is particularly relevant given the data presented earlier, which showed that the majority of learners in most programs receive some form of instruction in mathematics.

The percentage of teachers who were reported as certified in adult, elementary, or mathematics education, out of the total teaching force in programs, was 5.3%, 26.1%, and 4.2%, respectively. The finding that markedly fewer teachers are certified in mathematics compared to other fields holds in all program-size categories. (Note: Teachers may be certified in more than one field. Also, some teachers certified in elementary education may have received training in math education as part of this training, though it is not possible to obtain an exact figure without interviewing individual teachers).

We were interested to find whether programs recruit more teachers with certification in mathematics when a larger proportion of their students receive math instruction. As the data in Table 5 (see Appendix A) show, the percentage of teachers with math certification is much lower than the percentage of teachers certified in other areas, and is always less than 10%. Programs do not appear to hire many more teachers certified in mathematics education even when all or almost all of their students are learning mathematics.

In examining the employment status of the program instructors the study found that, of all the teachers employed by the programs surveyed, 85% were part-time. The comparable national figure for the 1990-1991 program year is 88% (U.S. Department of Education, 1993). The fact that the salaried teaching force in adult education is comprised mainly of part-time (usually hourly paid) teachers is noteworthy; part-time teachers are not likely to receive financial remuneration for participation in staff development activities, and thus they are less likely than full-time teachers to participate in training activities, even if these are available. Thus, the nature of the initial certification of teachers (which was shown above to be very low in the area of mathematics) and of preservice training activities (discussed next), becomes important, as part-time teachers are unlikely to receive much training after being hired.

PRESERVICE TRAINING

We asked programs to report how many hours of preservice training were provided to tutors and to teachers, and how many hours out of this preparation time, if any, were devoted to math instruction.

Only 158 programs provided any data on preservice training for tutors, the median duration of such training was 10 hours. Of these 158 programs, 93 (58.8%) addressed math issues in tutor preparation. Table 6 (see Appendix A) presents the median percentage of preservice time devoted to math as it relates to the percentage of students in tutoring sessions who were learning math. As can be seen, the percentage of training time allocated to math stays low even when a large percentage of tutees are engaged in math learning. The actual number of hours devoted to preparing tutors to teach math is very low: 71% of the programs that reported any math-related, tutor-preparation activities spend two hours or less on this topic, with only 29% spending more than two hours.

Data regarding preservice training for teachers were provided by 342 of the 350 programs surveyed. Of these, 322 programs held such training activities during 1992-1993. The median length of such training was six hours, with only 4.5% of the programs allocating more than 20 hours overall to preservice training for teachers. Of these 322 programs which trained teachers, 124 (38.5%) addressed math instruction issues in their preservice training for teachers, with the median time devoted to math issues less than two hours. Overall, 82.9% of the learners served by these 124 programs with some math training for teachers received math instruction at either the GED or non-GED levels. By contrast, the 198 programs that held preservice training activities for teachers, but did not allocate time to math issues, reported that 80.3% of their learners received some math instruction at either the GED or non-GED levels.

Table 7 (see Appendix A) presents the median percentage of time allocated to math instruction in preservice teacher training by the percentage of students who receive math-related instruction in either GED or non-GED classes. As with tutor training, time allocation is low and remains low even when a larger proportion of the students receive math-related instruction; this is so even in programs reporting that 90% or more of their students receive some math instruction. In absolute terms, only 17% of the programs allocated more than two hours to math instruction issues in preservice teacher training.

ASSESSMENT

Programs were asked to report the type of test(s) used to assess the mathematical skills of new students at the intake stage. Twenty-three out of the 350 programs surveyed (6.6%) did not respond to the question about assessment practices in math. Table 8 (see Appendix A) lists key assessment methods used at the intake stage by the 327 remaining programs.

A total of 72.6% of programs used one or more standardized tests, with the TABE Test being the single most widely used test (in 48% of all programs). Practically all these standardized tests (key types being the TABE, ABLE, WRAT, and GED practice test) have math subtests that employ multiple-choice items focusing on mechanical computation and word problems. Almost 16% of programs used the CASAS test, which focuses on functional skills through the use of real-world materials or tasks; 6.4% of the programs used only the

CASAS, and an additional 9.5% used the CASAS in combination with the TABE or some other standardized tests. These data are compatible with earlier findings showing that a majority of adult literacy programs rely on standardized tests (Sticht, 1990).

There are other findings of interest. Forty-two programs (12.0%) reported using no math-related assessment for incoming students; roughly three quarters of these programs were small programs emphasizing mostly reading and writing skills, yet the other programs claimed to teach all basic skills, including mathematics. A total of 24.8% of the programs used one or more locally developed tests; 9% of the programs used only a locally developed test, with the other 15.8% using it in combination with other tests. Student-self assessments were used by 9% of the programs in combination with other assessment methods, but never as the only assessment tool.

COMPUTER TECHNOLOGY

Programs were asked to report on two technology-related issues: Does the program have any computer software for teaching or drilling math skills, and what percentage of non-GED students who learn math actually use such software.

We focused on the availability of software for students working in non-GED classes as these students may need assistance in mastery and practice of basic skills. If computers are used at all at the GED level, they tend to be used for test preparation. As this study was concerned with instructional bases of computer use, programs were not asked about computer use by GED students.

Since basic software for practice of basic math skills has been available for at least a decade for all computer platforms, such software could be expected to be rather prevalent in adult education programs.

Overall, 80.1% of the 325 programs that responded to this part of the questionnaire reported that they have software for learning or drilling of math. As Table 9 (see Appendix A) shows, math software was reportedly more prevalent in programs with large numbers of students (69.5%, 86.9%, and 96.6% in small, medium, and large programs, respectively). However, the median percentage of non-GED students reported to be using math software by these 325 programs was only 20.0%. The median percentages of non-GED students reported as using math software remains low across all sizes of programs (40.0%, 20.0%, and 15.0% for small, medium, and large programs, respectively).

IMPLICATIONS FOR ADULT EDUCATION

Numerous calls have been issued in recent years to improve the status of mathematics education in America (National Research Council, 1989; National Science Board, 1983) and increase the relevance of educational

experiences to changing workplace requirements (Carnevale, Gainer, & Meltzer, 1990; SCANS, 1991, 1992). However, until the present survey, virtually no data were available to policymakers and planners at the federal and state levels about adult numeracy provision in the United States. The overall pattern of results from this study, which is based on a large cross-sectional sample of 350 adult literacy education programs from 15 different states that overall served over three quarters of a million students in 1992-1993, presents an alarming picture regarding the current state of mathematics education for adults attending literacy programs in the United States.

Over 80% of adult students appear to receive some math-related instruction at the adult secondary education or adult basic education levels. This fact has so far gone unrecognized in official reports because the reporting system currently in use around the nation and in different states is focused only on the number of students who engage in educational activities at different levels, rather than also on the content of such activities. However, such data regarding the extent of math-related activities are critical. They necessitate a discussion of staffing and staff training decisions and of plans for allocation of resources for training, curriculum development, and instruction, both internally by individual programs and externally by funding agencies at the state and federal levels. Questions raised by these and other findings presented earlier and their implications for decision makers, funders, administrators, and researchers are discussed below.

How Adequate Is the Training of Teachers and Tutors Who Teach Math to Adults?

Despite the fact that more than 80% of students were found to be engaged in math-related instructional activities, it seems that a majority of the teachers employed by adult programs lack formal preparation for teaching mathematics and are not being trained in this area before starting to work with adult learners.

The absence of a math component in a preservice program may not necessarily indicate that math instruction is neglected by this program; it is possible, for example, that the funding for a program requires it to focus instruction on reading and writing only, or that the program serves students for whom math is of low priority. (Some small programs may even use one teacher as math specialist to whom students requiring math instruction are sent, thus eliminating the need for other teachers in the same program to be trained in math instruction.) Yet, most students in programs of all sizes appear to receive math instruction, and it is thus paramount to find out if programs are organized to provide high-quality instruction in this area.

The gap between the number of students receiving instruction and the number of trained teachers is unsettling when one considers that there are only sporadic attempts to provide in-service staff development in adult education (Pelavin Associates, 1991). The problem of the lack of training is not unique to GED or ABE programs. As noted by Kutner, Sherman, Webb, and Fisher (1991) in a review of the national workplace literacy program, most of the training sites that they reviewed provided little preservice or in-service training to hired instructors; instead, programs relied on the teachers' prior professional qualifications in a specific content area, even if the teachers had relatively little

direct experience with adult learners and with workplace literacy programs (see Cumming, 1993, for an Australian example).

The importance of training in mathematics instruction for educators lacking background in this area is highlighted when one considers that the nature of mathematics teaching and learning is undergoing fundamental changes in K-12 schools (NCTM, 1989). For the last few years, K-12 mathematics educators and schools have been struggling with the process of gradually replacing or supplementing traditional drill-and-practice instruction (which places a premium on computational skills and memorized procedures) with broader notions of learning and using mathematics within realistic contexts that promote integrated reasoning, problem solving, and communication skills (Kloosterman, Hassan, & Weist, forthcoming).

How can changes in curricular goals and instructional frameworks in K-12 mathematics education reach or be adopted by the adult education community? The finding that over 80% of adult educators work on a part-time basis, combined with the fact that programs appear to spend few resources on in-service training, suggests that reforms in mathematics education may not have any measurable impact on adult educators without special attention and investment of resources.

What Is Required to Improve Teachers' Qualifications and Practices in Mathematics Teaching?

The reform process in K-12 mathematics education has required and continues to require extensive and continuous investment of resources, effort, and commitment by funding agencies and advocacy groups. In the case of K-12 mathematics education at the national level, the advocacy role has been fulfilled in large part by the National Council of Teachers of Mathematics (Lindquist, 1994). NCTM has made a heavy investment in formulating new curricular frameworks and promoting and disseminating a variety of materials to support its reform initiatives. Significant funding and support for training, research, and development initiatives aimed at improving K-12 mathematics education has been provided by agencies such as the U.S. Department of Education and the National Science Foundation, and by private foundations. However, organizations active at the K-12 level have not yet initiated any significant efforts to extend their interest and resources to improving adult mathematics education.

The importance of awareness for the need to reform K-12 mathematics education and of enabling teachers to have continuous training and access to new resources is critical to the impact of NCTM's reform efforts. A concerted effort and continuous advocacy and infusion of resources were needed over several years before reform efforts began to bear some fruits (Lindquist, 1994). Similar conclusions about factors that contribute to systemic educational reform are offered by Sashkin and Egermeier (1993) in a recent synthesis of research about school change models and processes published by the Office of Educational Research and Improvement (1988), U.S. Department of Education. In contrast, at present neither increased awareness for the need to improve the mathematics education of adults, nor increased investments in resources and stronger support for professional

development of adult educators in this regard are visible on the national or state levels in the United States.

One principle of the emerging "new" approach to the teaching of mathematics is that students learn more and better mathematics through active learning (NCTM, 1989). This principle has special importance for adult education in mathematics, as it can be assumed to contribute to students' ability to apply their new knowledge outside the classroom. What training should teachers receive in order to be able to engage students in active learning? In a recent summary of findings from studies about this question, the National Center for Research on Teacher Learning (1993) notes that "in order for teachers to teach for active [student] engagement in learning, they must possess subject matter knowledge and pedagogical content knowledge that goes *far beyond that typically provided* in teacher education" (p. 7, emphasis in the original).

How are new content and pedagogical knowledge to be acquired by teachers? Elsewhere, the National Center for Research on Teacher Learning (NCRTL, 1992) states that intensive but brief workshops (which are the most common form of staff development in adult education) are often ineffective in changing teachers beliefs and practices. NCRTL (1992) maintains that substantial changes in teaching practices may occur only when teachers (a) have extended and ongoing assistance, (b) are able to experiment with new approaches to teaching in their classrooms, and (c) have sufficient time to reflect on their new experiences and on their new role in the classroom. However, the present low level of preservice training in mathematics for adult educators, which in most programs amounts to only few hours per teacher per year, is unlikely to provide literacy educators with any meaningful preparation for teaching math to adults in accordance with new curricular and instructional frameworks. Isolated workshops or brief lectures that are provided at annual conferences, which are the present form of in-service training in most programs and states (Pelavin Associates, 1991), are not likely to provide the environment recommended by the NCRTL (1992, 1993) and Brown and Borko (1992) for changing beliefs about practice and the actual instructional methods of educators who teach mathematics.

The above concerns about the effectiveness of one-shot workshops may also hold for preservice training for tutors, which in most programs appears to be longer and more structured than preservice for teachers, but is nevertheless concentrated at the onset of instruction. As noted earlier, about one third of tutored students were reportedly learning some mathematics. Tutors usually operate in more isolation from other educators than do classroom teachers, and thus, tutors have fewer opportunities to receive ongoing support from their peers, which may in turn dilute any positive effect that an initial workshop may have had.

In thinking about possible avenues for improving the professional qualifications and practices of adult educators, it is important to keep in mind that an increase in the number of workshops offered or in the number of staff development hours per year is a necessary, but not a sufficient, step. There is a need to specify and ensure the actual content of teacher and tutor training in mathematics, and monitor its effects on participants and their students. Without such steps, it would be difficult to determine if training efforts have a measurable impact on teacher behavior and knowledge. Ball (1990), NCRTL

(1992), Sashkin and Egermeier (1993), and others provide many examples of how well-intentioned training programs, or the presentation of new curricular frameworks in a top-down fashion, do not translate into significant and lasting changes at the classroom level. As work by Lytle, Belzer, and Reumann (1992) and the Massachusetts ABE Math Team (1993) suggests, an ongoing and sustained process of teacher inquiry and reflection is essential for teachers to gain a deeper insight and identify effective ways to improve their practice.

LEARNING TO USE EDUCATIONAL TECHNOLOGY

One area that merits attention in any plan to improve numeracy provision involves the use of computers for teaching mathematics. As our findings suggest, despite the availability of computer software (which implies that hardware is also available), few learners appear to be able to take advantage of such educational technology, even though this technology holds significant promise for adult literacy education (Harris, Sadacca, & Hunter, 1985; Office of Technology Assessment, 1993; Turner, 1993).

A recent report by the Office of Technology Assessment asserts that no more than 15% of the literacy programs in the United States regularly use computers for instruction, a finding that in general agrees with our findings, that less than 30% of adult non-GED students use software for instruction. Of the many explanations raised to account for gaps between availability and usage of computer technology, a key argument refers to insufficient staff preparation. Existing math software presents many challenges to teachers who want to use it to support their instruction. Such software can support diverse types of classroom activities and learning goals, such as practicing basic arithmetic skills, learning functional skills through the use of simulations, using business applications such as spreadsheets or databases, learning statistical principles, and developing algebra or geometry principles and concepts using analytical programs (Kaput, 1992).

Software for teaching and learning mathematics requires teachers to master various skills and possess in some cases a nontrivial level of subject-matter knowledge; yet, such software also holds a lot of promise for adult educators. As Leonelli and Schwendeman (1994) note, most ABE, GED, or workplace classes are likely to include learners with multiple mathematical skill levels. Teaching in such a complex environment, while at the same time satisfying diverse learner goals, may be facilitated by judicious use of educational technology.

CAN ASSESSMENT FRAMEWORKS PRESENTLY IN USE PROVIDE ADEQUATE INFORMATION ABOUT ADULT NUMERACY SKILLS?

The finding that standardized tests, primarily the TABE, are used in a majority of programs in the United States for assessing the mathematical skills of incoming students raises many concerns. The math subtests of the TABE and other standardized tests in use employ multiple-choice items. Such items can provide useful information about computational skills in the context of school-like test problems. However, they provide very limited information, if any, about the kinds of mathematical skills highly emphasized in the new curricular frameworks in mathematics (NCTM, 1989) or in

specifications of skills required in high-performance workplaces (Carnevale et al., 1990; O'Neil, Allred, & Baker, 1992; SCANS, 1991). Problem-solving strategies, estimation and number-sense skills, and "quantitative literacy" skills (as defined in the NALS; see Kirsch et al., 1993) do not lend themselves easily to forced-choice assessment formats.

Recent discussions of new assessment frameworks in mathematics education (e.g., Lesh & Lamon, 1992; Mathematical Sciences Education Board, 1993; NCTM, 1993) point out that traditional standardized tests reveal little about students' conceptual understanding or the processes by which they solve problems. Neither do they examine those students' ability to apply their skills in functional contexts involving authentic problem environments. The Mathematical Sciences Education Board (MSEB) (1993), for example, lists several key principles that should underlie the development of high-quality assessments. In explaining the content principle, MSEB (1993) asserts that

> Any assessment of mathematics learning should first and foremost be anchored in important mathematics. . . . Appropriate tasks. . .[should] embed mathematics in relevant external situations, require students to communicate clearly their mathematical thinking, and promote facility in solving non-routine problems. . . . Considerations of connections, communication and nonroutine problems raise many thorny issues that test makers and teachers are only beginning to address. . . . Many of the assessments used today, such as standardized multiple-choice tests, have reinforced the view that the mathematics curriculum should be constructed from lists of narrow, isolated skills that can be easily disassembled for appraisal. The new vision of school mathematics requires a curriculum and matching assessment that is both broader and more integrated. (pp. 8-9)

In examining the potential impact of continued reliance on standardized tests for assessing the numeracy skills of adults, it is important to consider the specific limitations of the TABE and other tests. Sticht (1990), for example, has argued that the mathematical subtests of the TABE and ABLE are overly focused on decontextualized problems and have an inadequate sampling of items from different skill domains within mathematics. An example for a skill domain that is sorely underrepresented in the TABE is that of knowledge of percentages, which are very frequently encountered by adults in all facets of everyday and work contexts. In a content analysis of the TABE, no questions on percentages in the TABE math subtests aimed at learners in grade levels 1-4 and 5-8 were found. If the TABE reflects the curriculum content of K-12 schools, then percentages should have been included at the 5-8 level, as they are normally introduced to students as early as 5th grade. Also alarming was the finding that very few percentage questions are included in the TABE forms for grades 9 and above. Furthermore, these percentage questions are mostly restricted to interpretation of percentages in pie charts, and do not represent central, real-life situations in which adults have to use or make sense of percentages.

An important limitation of tests such as the TABE or ABLE results from their extensive reliance on decontextualized computational problems that involve little or no text. In so doing, such tests ignore the inherent links between

numeracy and literacy skills in everyday functional contexts, and do not address the expectation that learners of mathematics develop and are able to demonstrate a facility in "communicating mathematically" (NCTM, 1989; SCANS, 1991). In contrast, the assessment framework used in the NALS (Kirsch et al., 1993) asserts that "quantitative literacy" is one of several fundamental facets of literacy; this framework has led to the inclusion in the NALS of many functional tasks requiring application of arithmetical operations using numbers embedded in printed materials.

The overreliance on standardized tests in adult education has been repeatedly criticized in recent years for its limiting effect on the ability of programs, and of individual educators, to make sound decisions about student placement and about the focus of instructional activities (Lytle & Wolfe, 1989; Venezky, 1992). There is also a paradox inherent in the tendency to use standardized test scores to evaluate performance of programs, especially programs that purport to provide learners with job-related or functional skills, when the math sections of the tests used ignore or underrepresent important mathematical skills that are described as essential by employers (SCANS, 1991).

As McDonnell (1994) points out, many policymakers have an interest in using testing results to hold educational institutions accountable for student performance, or to serve as a basis for certifying individual students as having attained specific levels of mastery. In so doing, policymakers tend to ignore the reservations that testing experts have about the information that assessments do not provide, and the limitations on the technical capability of available assessments to support evaluative uses as desired by policymakers.

The discussion above implies that standardized tests currently in use assess only some of the many mathematical skills on which students' learning and progress should be evaluated or reported by programs. This limitation should be of major concern as adult education agencies in all the states continue to work on developing a system of indicators for program quality. Several of the model indicators released by the U.S. Department of Education specify areas where test results may be used as indicators of quality. In the area of Educational Gains, states are expected to have indicators capable of showing that "learners demonstrate progress toward attainment of basic skills and competencies that support their educational goals"; in the area of Curriculum and Instruction, indicators should show that the "program has curriculum and instruction geared to individual student learning styles and levels of student needs" (Center on Budget and Policy Priorities, 1993, p. 4).

As the Center on Budget and Policy Priorities (1993) noted, in implementing quality indicators, programs may end up using the narrow range of measures already available, such as standardized tests, since most programs are underfunded and have no resources to develop alternative assessments or to change their assessment practices. The heavy reliance on standardized tests for assessing the mathematical skills of students upon entering or leaving a program is likely to result in incomplete or distorted depictions of program quality, and may also cause more and more programs to "teach to the test."

As the data presented above suggest, a majority of adult educators in the United States work part time and also lack a strong background in math education. Under such circumstances, teachers may continue to rely heavily on standardized tests. Some incentives to use standardized tests are that they are convenient to administer and easy to score, and their results, though not too meaningful, are easily reportable. At the same time, if hiring and training practices remain unchanged, few resources and little time will be available to train teachers in using more informative (yet also more demanding and costly) alternative assessments (McDonnell, 1994). Because evaluation results will have consequences for program funding, the indicators and measures chosen may shape the content and scope of adult numeracy education for years to come.

SUMMARY

The following findings were established by this survey and its subsequent analysis:

- a very high percentage of adult students receive math-related instruction, the majority of whom are studying below "high school" level;
- the percentage of teachers certified to teach math is far smaller than the percentage of students who are receiving math instruction;
- few teachers receive any preservice training in mathematics;
- the math skills of most students are assessed using standardized tests; and
- although many programs report having computer technology available for math learning, relatively few students are using that technology.

These findings hold many implications for policymakers, researchers, program administrators, teachers, and learners. It is clear that more attention needs to be paid to adult mathematics instruction, especially in the following forms:

- teachers need to be provided more training in adult mathematics instruction and in the use of educational technology in this regard;
- programs need to make sure that the assessments of students' knowledge and achievement reflect the breadth and complexity of the numeracy skills required of adults, aspects that the popular assessment tools do not reflect; and
- reporting procedures for programs need to be developed so that information is available to state and federal agencies regarding the number of adult students who are receiving

math instruction, and the content or level of the mathematics instruction those students are receiving.

Attention to these areas will provide a significant step toward meeting the numeracy needs of adults in the United States.

ENDNOTES

[1] Current reporting schemes require programs to report the number of students receiving instruction at the ABE level (adult basic education, equivalent to grades 1-8) and at the ASE level (adult secondary education, equivalent to grades 9-12). Activities involving English-as-a-second language (ESL) students are reported separately.

[2] It is assumed that in most programs the same assessment tools used at the intake stage are used throughout the student's participation in the program, in order to facilitate tracking of progress, although further research is required to determine how extensively this occurs.

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Table 1

Characteristics of Programs in Sample

	Program size[a]			
	Small	**Medium**	**Large**	**Whole sample**
Overall # of programs	180	139	31	350
Median # of sites per program	2	9	50	4
# Students in classes	30,253	229,708	472,584	732,545
# Students in tutoring	9,709	20,197	12,504	42,410
Total # of students served	39,962	249,905	485,088	774,955

[a] Programs were separated by size (by number of students served) to reduce bias resulting from influence of large programs. Programs were divided as such: Small (1-599 students served), Medium (600-9,999 students served), and Large (10,000+ students served).

Table 2

Characteristics of Students in Sample, With National Data[a]

	Program size[b]				National data[c]
	Small	**Medium**	**Large**	**Whole sample**	**1990-1991**
% of students at GED level	25.7%	30.8%	28.0%	28.8%	32.0%
% of students who are female	48.3%	44.8%	50.5%	48.5%	52.0%
% of students who are ESL	27.3%	30.1%	39.0%	35.5%	32.0%

[a] Percentages are percentages of all students in programs in each size category having certain characteristics. For example, 25.7% of the students in small programs in the sample (programs serving fewer than 600 students) are studying at the GED level.

[b] Programs were separated by size (by number of students served) to reduce bias resulting from influence of large programs. Programs were divided as such: Small (1-599 students served), Medium (600-9,999 students served), and Large (10,000+ students served).

[c] Data from U.S. Department of Education (1993), *Adult education delivery system trends: Program year 1990-1991,* Washington, DC: Division of Adult Education and Literacy.

Table 3

Comparison of Programs in Sample and Students Served With National Data

State	Programs in sample				National data[a]	
	Programs		Students		1990-1991	
	Number of programs	*% of total programs in sample*	*Number of students in sample*	*% of total students in sample*	*Number of students served*	*% of total students served*
West						
California	61	17.4%	145,493	18.8%	1,022,583	40.2%
Idaho	5	1.4	5,897	0.8	10,215	0.4
Washington	23	6.6	19,687	2.5	34,401	1.4
South						
Florida	38	10.9	136,201	17.6	436,766	17.2
Arizona	11	3.1	20,561	2.7	30,845	1.2
Texas	28	8.0	152,728	19.7	220,027	8.7
Tennessee	13	3.7	19,536	2.5	49,556	1.9
East						
District of Columbia	16	4.6	11,267	1.5	20,309	0.8
Maryland	22	6.3	41,686	5.4	53,505	2.1
New Jersey	10	2.9	2,851	3.7	65,379	2.6
New York	23	6.6	31,744	4.1	182,879	7.2
Pennsylvania	25	7.1	6,099	0.8	48,590	1.9
Midwest						
Illinois	29	6.1	133,950	17.2	91,383	3.6
Michigan	35	8.3	35,766	4.6	205,545	8.0
Wisconsin	11	3.1	11,489	1.5	70,838	2.8
Total	350	100.0%	774,955	100.0%	2,542,821	100.0%

[a] Data from U.S. Department of Education (1993), *Adult education delivery system trends: Program year 1990-1991*, Washington, DC: Division of Adult Education and Literacy.

Table 4

Percentages of Students in Sample Receiving Math Instruction[a]

	Program size[b]			
	Small	**Medium**	**Large**	**Whole sample**
Total # students	39,962	249,905	419,133	774,955
% of total students receiving math	63.3%	68.9%	86.4%	79.6%
% of total students receiving no math	36.7%	31.1%	13.6%	20.4%
# of students in classes	30,253	229,708	472,584	732,545
% of students in classes receiving math	73.9%	71.3%	86.5%	82.2%
% of students in GED math	33.9%	33.4%	28.7%	31.4%
% of students in math below GED level	40.0%	37.9%	57.8%	50.8%
% of students in classes receiving no math	26.1%	28.7%	13.5%	17.8%
# of students in tutoring	9,709	20,197	12,504	42,410
% of students in tutoring receiving math	30.3%	40.2%	81.7%	50.2%
% of students in tutoring receiving no math	69.7%	59.8%	18.3%	49.8%

[a] Percentages are percentages of all students in programs in each size category having certain characteristics. For example, 86.5% of the students studying in classes in large programs (programs serving 10,000+ students) receive some math instruction.

[b] Programs were separated by size (by number of students served) to reduce bias resulting from influence of large programs. Programs were divided as such: Small (1-599 students served), Medium (600-9,999 students served), and Large (10,000+ students served).

Table 5

Percentages of Teachers Certified in Education Areas in Programs, by Proportion of Students in Classes Taking Math[ab]

	Proportion of students in classes taking math					
	None	Low	Medium		High	
Certif. area	0%	1-25%	26-50%	51-75%	76-100%	Whole sample
Math education	0.0	0.0	4.0	5.0	6.3	4.2
Element. education	0.0	8.5	20.3	20.0	34.3	26.1
Adult education	25.0	7.6	6.7	9.4	4.3	5.3
No. of programs	15	26	31	42	208	322

[a] Columns contain all programs having a certain percentage of students in classes studying math. For example, all programs (N=26) having between 1 and 25% of the students in their classes studying math are contained in the second column (1-25%).

[b] Percentages are median percentages of teachers certified in the specified area in each column. For example, half the programs having between 76 and 100% of the students in their classes studying math have fewer than 6.3% of their teachers certified in math education, and half the programs having that percentage of students studying math in their program have more than 6.3% of their teachers certified in math education.

Table 6

Percentages of Training Time Devoted to Math in Tutor Training in Programs, by Proportion of Students in Tutoring Taking Math

	Proportion of students in tutoring taking math[a]					
	None	Low	Medium		High	
	0%	1-25%	26-50%	51-75%	76-100%	Whole sample
% of tutor training time devoted to math[b]	0.0	8.3	16.7	16.7	8.1	10.0
No. of Programs	21	56	21	13	47	158

[a] Columns contain all programs having a certain percentage of students in 1-to-1 tutoring studying math. For example, all programs (N=56) having between 1 and 25% of the students in tutoring studying math are contained in the second column (1-25%).

[b] Percentages are median percentages of tutor training time devoted to math in each column. For example, half the programs having between 51 and 75% of the students in 1-to-1 tutoring studying math devote less than 16.7% of their tutor training time to math topics, and half of the programs having that percentage of their students in tutoring studying math devote more than 16.7% of their training time to math topics.

Table 7

Percentages of Training Time Devoted to Math in Teacher Training in Programs, by Proportion of Students in Classes Taking Math

	Proportion of students in classes taking math[a]					
	None	Low	Medium		High	
	0%	1-25%	26-50%	51-75%	76-100%	Whole sample
% of teacher training devoted to math[b]	0.0	0.0	20.0	16.7	20.0	20.0
No. of programs	15	26	31	42	208	322

[a] Columns contain all programs having a certain percentage of students in classes studying math. For example, all programs (N=26) having between 1 and 25% of the students in tutoring studying math are contained in the second column (1-25%).

[b] Percentages are median percentages of teacher training time devoted to math in each column. For example, half the programs having between 26 and 50% of the students in classes studying math devote less than 20.0% of their tutor training time to math topics, and half of the programs having that percentage of their students in classes studying math devote more than 20.0% of their training time to math topics.

Table 8

Assessment Methods Used at Intake[a]

Assessment type	Percentage of programs
TABE alone	35.8%
TABE with other std. tests	12.2%
Non-TABE std. tests	15.1%
TABE or other std. tests with CASAS	9.5%
CASAS alone	6.4%
Locally developed test only	9.0%
No testing	12.0%
Total	100.0%

[a] N=327 programs responding to assessment questions.

Table 9

Use and Possession of Math Software

	Program size[a]			
	Small	**Medium**	**Large**	**Whole sample**
% programs with math software[b]	69.5%	86.9%	96.6%	80.1%
% of non-GED students in classes using software[c]	40.0%	20.0%	15.0%	20.0%

[a] Programs were separated by size (by number of students served) to reduce bias resulting from influence of large programs. Programs were divided as such: Small (1-599 students served), Medium (600-9,999 students served), and Large (10,000+ students served).

[b] Percentage is the percentage of programs possessing math software of all programs in the specified size category.

[c] Percentage is the median percentage of students in classes below GED level who are using math software to learn in programs possessing math software in the specified size category. For example, half the programs in the medium size category (serving between 600 and 9,999 students) which possess math software have fewer than 20.0% of their students below GED level using math software to learn, and half of the programs in that size category possessing math software have more than 20.0% of their students below GED level using math software to learn.

APPENDIX B

Survey Forms . *B–iii*

Please return ASAP in the enclosed envelope,
or mail to: Numeracy Survey, NCAL
3910 Chestnut St., Philadelphia,
PA 19104-3111

Survey:
Numeracy & Math in Adult Literacy Education

Contact Information

1. Name of agency/program: _____

2. Location (city/state only): _____

3. Your name: _____ Position: _____

Your Program ("Program" refers to the aggregate of *all* sites your agency serves. We know it is not easy to provide accurate information for multiple sites; please give your best estimate, or a range if not completely sure. If no reliable data exists, write "data unavailable" or just "DU")

4. How many sites does your program have? _____

5. In what area are you located? Circle one, or two to indicate a "mixture." (On this and all other questions, please circle "Other" and explain in your words if no option seems suitable)

   1. Large metropolitan area - inner-city/urban location(s)
   2. Large metropolitan area - suburban location(s)
   3. City / small town within 25 miles of a large metropolitan area
   4. Small town in a rural area, or other locations not near a metropolitan area
   5. Other - please explain:

6. What is the primary emphasis of your program? Circle one, or two to indicate a "mixture":
   1. Reading/writing only (usually, we don't teach math at all)
   2. Mostly reading/writing; other skills, such as math, only if students ask for
   3. All basic skills (including math)
   4. Other - please explain:

7. *Over the last 12 months*, how many students were served by your program (all sites)?

   A. In groups /classes: _____ (of these, ____% were ESL students; and ____% females)

   B. In 1 to 1 tutoring: _____ (of these, ____% were ESL students; and ____% females)

8. Over the last 12 months, how many of the students who worked in *groups* received some *math-related instruction*, either in a separate math class, or as part of other class activity?
Please break down the total number of students in groups (see line 7A) into GED students (who almost always work on math), *non*-GED students who did *some* math-related work, and non-GED students who received *no* instruction in math. (The percents in A-C below should sum to 100%).

   A. _____% of our students worked directly towards GED

   B. _____% of our students were non-GED who received **some** math-related instruction

      (this is broken down into _____% ESL students, and _____% non-ESL)

   C. _____% of our students were non-GED and received **no** math-related instruction

9. Over the last 12 months, to the best of your knowledge, what percent of students in 1-on-1 *tutoring* (see line 7B) received some math instruction ? _____%

Demand for instruction in math

10a. During your program's intake/admission process, are **new** non-GED students (in classes) asked if they are interested in learning math/numeracy? Please read all options and circle one:

A. We **don't** specifically ask about math, because our program focuses primarily on reading/writing skills. Yet, students might bring up math interests on their own.

B. We **don't** specifically ask about math, because we teach math anyway to most students as part of our curriculum, hence there is no point in asking about it.

C. We **do** ask all new students if they want to learn or improve math-related skills.

D. Other-please explain:

10b. Are new students who will be in 1-on-1 *tutoring* asked about interest in math? **Yes No**

10c. Please estimate what percent of all non-GED students (in classes) express interest in learning math (regardless of whether or not they are specifically asked about math during the intake procedure): _____%, or circle **DU**

11. Are there non-GED students who ask for, or need, math instruction but **do not** receive it? (Circle either "1" or "2"; If you circle 1, also circle all sub-options that apply)

1. Not all those who want/need math eventually receive instruction. This is because:
   - A. math is not the focus of our program
   - B. not enough qualified teachers are available in our area
   - C. lack of funding
   - D. Other-please explain:

2. All those who ask for or need to improve math skills do receive instruction.

Teaching & staff

12. How many teachers or tutors does your program have? (please fill A-C below. Make sure not to include the same person in more than one category)

A. Full-time teachers _____ B. Part-time teachers _____ C. 1-to-1 *Tutors* _____

13. What about teachers' "official" certification? We know that this varies a lot, depending on state regulations, funding, etc., and is not seen as helpful by many programs. With this in mind, please indicate, to the best of your knowledge, how many teachers (either full or part time) are:

A Certified as *adult educators*: _____

B Certified in *elementary* education: _____ (any subject, including math)

C. Certified as *math* teachers: _____ (for either elementary or higher grades)

14a. On average, how many hours of *pre*-service training are given to new **teachers** (before they start teaching in your program): _____

14b. How many hours of this *pre*-service training for teachers, if any, are devoted to *math or numeracy* instruction: _____

15a. On average, how many hours of *pre*-service training are given to new **tutors** (who will work 1 on 1) before they start tutoring: _____

15b. How many hours of this *pre*-service training for tutors, if any, are devoted to *math or numeracy* instruction: _____

16a. Does your program have any computer software for math-learning/drill? **Yes No**

16b. If so, what percentage of non-GED students who learn math use this software? _____%

17a. Did you have any workplace literacy classes in the last 12 months (on / off site)? **Yes No**

17b. If so - did these classes involve teaching of any math or numeracy skills? **Yes No**

Please elaborate (e.g., what company? what math skills? Any contacts we can follow?)

_____

_____

Assessment

18. Does your program assess students' knowledge of <u>math</u> at intake? Circle all that apply. Please add comments as needed:

A. No. We do not assess math skills at all at the intake/admission stage.

B. We use the following standardized test(s) - please circle:

1-TABE 2-ABLE 3-WART 4-TASK 5-CASAS 6-Other: _____

C. We use a locally-developed test. It covers _____

D. We ask students to fill a "self-assessment" on which they rate their own skills.

E. Other-please specify:

19. We want to gauge at what levels students start their math studies. This is not easy since programs use different assessment methods, and because not all math skills necessarily fit on "levels". Yet, any information is important and will help us know what instructional needs might exist. Try to estimate what percentage of new *non*-GED students started your program in the last 12 months at the following levels: (Please skip our categories and provide other data, if you feel that it will be more descriptive of your students...or write "data unavailable"):

A. _____% started by working on **place value, 4 operations, or other "very basic" skills**

B. _____% started by working on **fractions, decimals, percents etc.**

C. _____% started by working on **algebra (or "higher" skills)**

D. _____ Other-please specify:

Needs: Below we ask about **needs** related to math/numeracy education. This information is crucial to help us plan activities and development projects and decide on areas to recommend for more attention by federal and state agencies. If your program does not focus on numeracy, you may still respond to the questions below or you may write "not applicable."

In thinking about needs, ask yourself: Are you satisfied with the level and nature of math/numeracy instruction your program is providing? We of course know that funding is an issue for most programs. Yet, at this point we are trying to identify the nature of the *issues* that need to be addressed, putting questions of more funding aside, despite their importance. We ask about needs in three areas: Staff preparation, instructional materials, and assessment methods. Attach additional comments on a separate page. It would help us if you write legibly. If you can, please also send samples of materials, special tests developed by your program, or other information about your math curriculum. Thanks!

20. Describe any gaps & needs in **staff-development** or **teacher / tutor preparation** for math/numeracy instruction. Should your staff's preparation or comfort level in these areas be improved? Do teachers or tutors have somebody to consult with? Any suggestions ?

Pre-service _____

_____

_____

In-service _____

_____

_____

21. What gaps & needs do you see in the area of **instructional resources** in math/numeracy? Do you find instructional resources , such as texts, workbooks, materials, calculators, software, etc., appropriate for helping students achieve their goals? Any suggestions?

_____

_____

_____

_____

22. What gaps & needs do you see in **assessment** of math/numeracy skills or competencies? (include beginning, interim, and end of studies assessments). Do assessment instruments provide your teachers and students with adequate information? Any suggestions?

_____

_____

_____

_____

23. We might want to call you to clarify any answers (or just to say a personal 'thank you'...) If you wouldn't mind talking to us, please write your phone number:

_____

24. **Other thoughts/ Comments**? Please describe any other problems, new products needed, or research needed in adult numeracy education which were not covered elsewhere, and that you want us to know about. Use the other side or attach additional pages.

Thank you very much for taking the time to answer this survey.

We will send you a report summarizing results from the survey in mid-December, and will add your name to our mailing list so that you receive our newsletter, the *NCAL connections*.